



ARPA-E's 37 Projects Selected From Funding Opportunity Announcement #1

Project Title: Shewanella as an Ideal Platform for Producing Hydrocarbon Biofuels
Organization: University of Minnesota
Funding Amount: \$2,200,000
Website: www.umn.edu

Brief Description of Project

This research couples transformational systems biology and bioprocessing with biorefining technology to be performed by a team of biologists, chemists, engineers, and a biotechnology-driven company, BioCee. The research uses *Shewanella* bacteria to make hydrocarbon biofuels. Hydrocarbon biofuels are superior to ethanol, resemble current petroleum-based fuels, and thus will require little changes to public infrastructure. We have shown that native *Shewanella* species produce hydrocarbons, are tolerant to hydrocarbons, and can be engineered to produce higher levels of hydrocarbons. The Department of Energy (DOE) has invested heavily in research designed to deeply understand fundamental *Shewanella* biology and that will be leveraged here. With collaborators at the Pacific Northwest National Laboratory, the University of Minnesota will explore phototroph-*Shewanella* co-co-cultures for generating hydrocarbons from carbon dioxide. This proposed research will explore innovative bio-production methodologies to allow continuous harvesting of hydrocarbons with an order of magnitude cost savings over traditional batch fermentation. The hydrocarbon feedstock generated by this novel approach will be chemically processed using knowledge obtained from a century of petroleum refining.

Why ARPA-E Funding and Not Private Capital

The research is potentially transformational and is thus not being conducted industrially. High-risk, high payoff research is needed to dramatically increase our nation's efficiency in generating fuels from renewable resources. The present research is designed to produce hydrocarbon fuels. Hydrocarbon fuels are a higher-energy fuel than ethanol and can theoretically be produced in greater titers. Moreover, the project is investigating a revolutionary approach, combining photosynthetic and fuel producing organisms in novel production mode in latex thin films. This approach produces fuel from carbon dioxide. It is unlikely that industry that will fund such revolutionary research.

Uniqueness/Benefits of Technology

The research generates the most desirable fuel in a novel technology. Producing fuels from carbon dioxide is highly desirable. It accomplishes both carbon dioxide removal from the atmosphere and making an efficient transportation fuel in the same process.

Addressable Market & Potential Customers

The product of the research is transportation fuel. The potential customers are American citizens. An important feature of the research is that the fuels to be produced resemble current petroleum-based fuels. Hence, they can be refined and distributed using existing infrastructure. The potential benefit is that the fuels will be derived from renewable resources.



For inquiries, contact:

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Key Team Member Bios

Lawrence P. Wackett is the Principle Investigator. He is Distinguished McKnight University Professor in the Department of Biochemistry, Molecular Biology and Biophysics at the University of Minnesota

Aditya Bhan is a co-PI and an Assistant Professor in the Department of Chemical Engineering and Materials Science at the University of Minnesota.

Jeffrey Gralnick is a co-PI and an Assistant Professor in the Department of Microbiology and the BioTechnology Institute at the University of Minnesota.

Lanny Schmidt is a co-PI a Regents Professor in the Department of Chemical Engineering and Materials Science at the University of Minnesota.

Marc von Keitz is a co-PI and the Chief Scientific Officer of the biotechnology company, Bio-Cee, Inc.

Miscellaneous

If the research is successful, the production of hydrocarbons biologically will interface with many stakeholders. The process will be highly compatible with feedstocks and processes used currently by major oil and chemical companies. In this context, there are many potential investors and customers for the process under development.



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